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Cobalt supported on ZrO_2: catalysts characterization and their activity for the reduction of NO with C_3H_6 in the presence of excess O_2

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Abstract

CoO_x/ZrO_2 samples, prepared by adsorption from cobalt solutions or by impregnation, were characterized by means of DRS, XPS, FTIR and volumetric CO adsorption. In samples prepared by adsorption the maximum Co-uptake was 2.2 atoms nm^{-2}. XPS evidenced cobalt dispersion up to about 2 atoms nm^{-2}. DRS evidenced Co_3O_4 above 2 atoms nm^{-2}. Volumetric CO adsorption, combined with FTIR, showed that cobalt was highly dispersed on the ZrO_2 surface in samples containing 0.4 and 0.9 atoms nm^{-2}. The selective catalytic reduction (SCR) of NO with C_3H_6 in the presence of excess O_2 was studied on samples containing up to 4.8 Co atoms nm^{-2} with a reactant mixture containing NO=4000 ppm, C_3H_6=2000 ppm, O_2=2%. Isolated cobalt in CoO_x/ZrO_2 containing up to about 2 atoms nm^{-2} is active and selective for NO reduction in the presence of excess O_2. Aggregated cobalt present as Co_3O_4 in more concentrated samples is active for C_3H_6 combustion, thus rendering the relevant CoO_x/ZrO_2 samples non-selective.

Author Keywords: NO abatement; ZrO_2 support; Supported cobalt oxide